REMARKS

Reconsideration of this application, as amended, is respectfully requested.

This application has been reviewed in light of the Office Action dated March 12, 2004. Claims 63, 64, 66, 67, 69, 72, 73, 75, 76, 78-80, 87, 88, 91, 97, 98 and 100-108 are pending in the application. As indicated above, Claim 102 has been amended.

In the Office Action, the Examiner has rejected Claims 63, 64, 66, 67, 69, 72, 73, 75, 76, 78-80, 87, -88, 91, 97, 98 and 100-108 under 35 U.S.C. §103(a) as being unpatentable over Applicants' Admitted prior art (*AAPA*) in view of *Webster* (U.S. Patent 5,307,351). The Examiner has rejected Claims 64, 73, 102 and 105 under 35 U.S.C. §103(a) as being unpatentable over *AAPA* in view of *Webster*, and further in view of *MacNamee et al.* (U.S. Patent 5,212,684).

Again, prior to addressing the rejections contained in the Office Action, the Examiner is respectfully presented with the following information to further an understanding of the present invention and at least some of its distinctions from the cited references. As discussed at page 3 to 4 of the present application, in the general mobile communication system various types of data are transmitted and received, each type having a different QoS (Quality of Service) depending on the characteristics of the data (i.e., voice data or packet data). Such variable QoSs translate into variable data frame lengths. Data rate can vary from several kbps to several Mbps depending on the type of service, such as voice or data (packet data), and frame length according to the data rate can also vary from several ms to several hundreds of ms.

The variable frame size disclosed by *Webster*, is not the "input data frame of variable size" of the present application; and in the present application, the "input data frame of variable size" is distinguished from the sub frame/super frame. Also, as the Examiner is well aware, turbo coding is a new channel coding scheme applied to the 3rd Generation (WCDMA and CDMA2000) mobile communication systems.

In the turbo coding scheme disclosed in the present application, the greater the size of the

code block (i.e. input data frame size), the greater the efficiency of the turbo coding. The size of the code block and efficiency of the turbo encoder have a linear relationship. As the size of the code block increases, the linear increase of the efficiency reaches maximum efficiency at a determinable block size. Accordingly, if a block size is greater than said determinable block size, for example, the prior art system experiences performance degradation due to an increase in receiver memory size and complexity. Also, in the case of code block sizes that are less than a predetermined block size, the smaller block size may cause efficiency deterioration compared with a block code or convolutional code scheme. Accordingly, in a system utilizing a turbo code, by considering such factors as the characteristics cited above, that is the input data frame size (number of input data bits) input to a turbo encoder, and readjusting the frame size based on the need for maximum efficiency, efficiency of the coding can be maximized when channel coding is performed.

The present application discloses a system and method to determine how to segment an original input data frame in order to maximize efficiency. Accordingly, it is respectfully submitted that the present application is distinguishable over the *Webster* reference, which merely discloses generating variable size input data, not segmenting an original input data frame.

The Examiner states that the *AAPA*, at least in part, discloses the present invention. Figs. 1 and 2 of the admitted prior art illustrate basic elements of a prior art turbo encoder and decoder. The turbo encoder of the Fig. 1 does not include a specific procedure or apparatus for segmenting input data frames.

As indicated above, Claim 63 recites a processor for determining a number and a size of sub frames, which can be generated from the input data frame of variable size, according to a size of the input data frame. The processor as claimed in Claim 63 is not present in the *AAPA*, as the *AAPA* turbo encoder does not determine the number and size of sub frames from input data frames. The Examiner cites *Webster* as disclosing, "data assembly ***based on channel characteristics...bit error rates...transmission line quality...***" However, as was previously presented, *Webster* does not adjust the size of the data blocks input into a turbo encoder for the purpose of maximizing turbo encoding efficiency as recited in Claim 63. In *Webster*, when the amount of retransmissions requested is high, a frame is adjusted to a smaller size as it is

determined that channel conditions are not good, but if the amount of retransmissions requested is few, a frame is adjusted to a large size so as to compensate for channel conditions. On the contrary, the present invention analyzes and adjusts input data frame sizes in order to optimize efficiency of the turbo encoding. That is, the "variable frame size" as used in *Webster* is the "input data frame of variable size" in the preamble of Claim 63.

Regarding claims 63, 66, 67, 69, 72, 75, 76, 78-80, 87, 88, 91, 98, 100-104 and 106-108, block 16 of Fig. 1 in the admitted prior art, relates to a turbo encoder internal interleaver, but Claims 63, 66, 67, 69, 72, 75, 76, 78-80, 87, 88, 91, 98, 100-104 and 106-108 of the present application disclose a channel interleaver. The feature of adjusting the input data frame size of a channel code is disclosed by the present application for the first time. *Webster* does not describe features related to channel coding and channel interleaving. The present application generates the sub frames by segmenting the input data frame having a variable frame length according to a predetermined condition, i.e., a size of input data frame, and performs channel encoding (turbo encoding) for each sub frame. Then the encoded sub frames originating from the input data frame are combined into one encoded data frame, and the encoded data frame is channel interleaved. However, the cited reference, *Webster*, and conventional mobile communication systems do not perform such an operation. Based on at least the foregoing arguments, withdrawal of the rejections of Claims 63, 66, 67, 69, 72, 75, 76, 78-80, 87, 88, 91, 98, 100-104 and 106-108 is respectfully requested.

Regarding the rejection of Claims 64, 73, 102 and 105 under §103(a) as being unpatentable over the *AAPA*, *Webster* and *MacNamee*, Figs. 1-2, page 1 last paragraph to page 4 paragraph 2 of the present application indicated by the Examiner, fails to disclose the subject matter of the present application, i.e., channel interleaving and multiplexing. Regarding the rejection as based on the multiplexing step, as seen from col. 5 lines 15 to 22, block 22 of Fig. 5 in the cited reference, *MacNamee* indicates means for selecting one among three predetermined time slots to transmit information, as seen from col. 5, lines 41 to 44, block 34 of Fig. 5, which indicates means for selecting a time slot on which the information is transmitted. On the contrary, the multiplexer of Claims 64, 73, 102 and 105 in the present application, is connected to a turbo encoder and is a means for efficiently multiplexing outputs, since there is a plurality of output streams for one input data bits in the characteristics of a turbo encoder. The multiplexer of

the present application is the same in name only with the multiplexer of blocks 22 and 34 of Fig. 5 of *MacNamee* indicated by the Examiner, but is totally different from those in the *MacNamee* reference. Col. 2, lines 10 to 16 of *MacNamee* relates to a frame structure for supporting a DECT/TDMA system and does not disclose a multiplexer as in the claims of the present application. Furthermore, the Examiner alleges that the multiplexing means includes a controlling function for memory size or permissible delay, which are conditions for determining its number of sub frames; the multiplexer recited in the claims of the present application does not relate to such a function. Finally, there is not even mentioned the feature of memory size or permissible delay in col. 2, lines 10 to 16 of *MacNamee*. Based on at least the foregoing arguments, withdrawal of the rejections of Claims 64, 73, 102 and 105 is respectfully requested.

In response to the Examiner's remarks in paragraph 1.1, an ECC means, which is indicated by the Examiner, is equivalent with a CRC attachment operation defined in a normal mobile communication system. This is specifically demonstrated by the phrase "*ECC means is preemptively inserted into said data frame*". However, the CRC attachment operation is an upper layer function (for example, using 3GPP, the CRC attachment operation would indicate a MAC layer function). However, channel coding and channel interleaving are Physical layer functions and are different error correction/detection functions from the CRC attachment operation.

Further, channel coding according to the present application generates encoded bits for the input data frame, but ECC means or other bits are not inserted into the input data frame.

Besides, a feature of error detection, which is disclosed in col. 1, line 48 of *Webster*, relates to CRC attachment (an error check part in Fig. 2 of *Webster*). Accordingly, the ECC means of *Webster* is different from a turbo code of the present application.

The Examiner also alleges that *Webster* discloses *efficient data communications means wherein breaking original messages into plural data frames*, but such a feature cannot be founded in *Webster*. More specifically, *Webster* is not related to channel encoding. As shown in Fig. 2, *Webster* suggests a method for generating a frame having variable size according to a channel condition in a high layer. In other words, *Webster* relates to a frame assembling method.

For example, in *Webster*, if the number of retransmission requests calculated in a unit of a plurality of transmission frames is small, the number of bits in a data frame is increased to increase the frame size, and if the number of retransmission requests is large, the number of bits in a data frame is decreased to decrease the number of the frame size. This is based on the fact that the size of overhead part (flag, control info & error check) is uniform regardless of the size of a data part of a transmission frame in a mobile communication system. Such a feature is disclosed in col. 1, line 46 et seq., col. 5, line 52 et seq., col. 6, line 14 et seq., and col. 6, line 36 et seq., and the drawings of *Webster*. Therefore, it is respectfully submitted that *Webster* does not teach breaking original messages into plural data frames, as is asserted by the Examiner.

Regarding the Examiner's remarks in paragraph 1.2, in the comments previously submitted and re-submitted above, it is submitted that *Webster* fails to disclose a channel interleaver, and while *MacNamee* mentions a channel interleaver, as indicated by the Examiner, *MacNamee* just mentions the phrase "channel interleaving". That is, *MacNamee* fails to disclose its operation or structure in detail or otherwise. Further, as indicated above, *Webster* does not suggest a scheme for dividing a frame as in the present invention. Specifically, col. 1, line 46 of *Webster* does not suggest a scheme for dividing a previously generated frame, but suggests a scheme for generating a frame, shown in Fig. 2, by grouping information data and overhead data, i.e., flag, control info, and error check.

However, the claims of the present invention disclose a scheme for dividing a frame, which is generated by grouping information data and overhead data, i.e., flag, control info, and error check, into sub frames, performing encoding in a unit of the sub frame, and then, performing channel interleaving in a unit of an original frame by combining the encoded symbols. Accordingly, it is respectfully submitted that the features of channel interleaving as presented in the claims of the present application is patentable over any of the Examiner's cited art, alone or in combination.

Regarding the Examiner's remarks in paragraph 1.3, it is respectfully submitted that *Webster* cannot be utilized for aims of the present invention because the application steps and operations are different from each other in a signal processing procedure.

Regarding the Examiner's remarks in paragraph 1.4, factors affecting performance of a turbo code, i.e., "*according to a size of the input data frame*", are recited in the claims.

Regarding the Examiner's remarks in paragraph 1.5, it is respectfully submitted that a feature of "interleaving" is novel, as described above, in response to the remarks in paragraph 1.2. Further, regarding "variable length frame feature", the present invention discloses dividing variable length frame input to a turbo code according to predetermined conditions, and illustrates examples of the variable length frame in page 3 to 4 of the present application. That is, if a single transport block exists within a TTI (Transmit Time Interval), the present invention presents, as a simplest example, that a frame as shown in Fig. 2 *Webster* is divided into sub frames and encoded in a unit of the sub frame according to the predetermined conditions.

Regarding the Examiner's remarks in paragraph 1.6, the multiplexing means in *MacNamee* performs selecting a time slot assigned to a TDMA system. However, a multiplexer in claim 102 of the present invention is for multiplexing a systematic stream output from a turbo encoder and a plurality of parity streams. Accordingly, the multiplexing means in *MacNamee* is a selector, which distinct the multiplexer as recited in the claims of the present invention.

Regarding the Examiner's remarks in paragraph 2.1, a turbo code of the admitted prior art indicated by the Examiner is not performed on a unit of a sub frame. Further, *Webster's* disclosure is different from the one of the present application as described above. More specifically, col. 2, line 40 of *Webster* discloses "data transfer frame length is dynamically adjusted", which means variably adjusting the number of bits of information data when structuring a frame with overhead data and information data in a high layer, and "based on the quality of the transmission line or channel", which means the number of transmission requests, which are different from various conditions for dividing a frame as in the present invention, for example, "a size of the input data frame". Accordingly, withdrawal of the rejection is respectfully requested.

Regarding interleaving, claims 64 and 73 claim channel interleaving and are patentable as mentioned above. Further, claim 105 also discloses an internal interleaver of a turbo code. Meanwhile, an internal interleaver of the admitted prior art does not perform interleaving as a

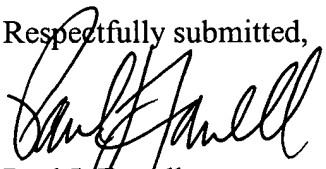
unit of a sub frame.

Based on at least the foregoing, withdrawal of the rejections of the claims is respectfully requested.

Independent Claims 63, 72, 79, 87, 91 and 97 are believed to be in condition for allowance. Without conceding the patentability per se of dependent Claims 64, 66, 67, 69, 73, 75, 76, 78, 80, 88, 98 and 100-108, these are likewise believed to be allowable by virtue of their dependence on their respective amended independent claims.

Accordingly, all of the claims pending in the Application, namely, Claims 63, 64, 66, 67, 69, 72, 73, 75, 76, 78-80, 87, 88, 91, 97, 98 and 100-108, are believed to be in condition for allowance. Should the Examiner believe that a telephone conference or personal interview would facilitate resolution of any remaining matters, the Examiner may contact Applicants' attorney at the number given below.

Respectfully submitted,



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